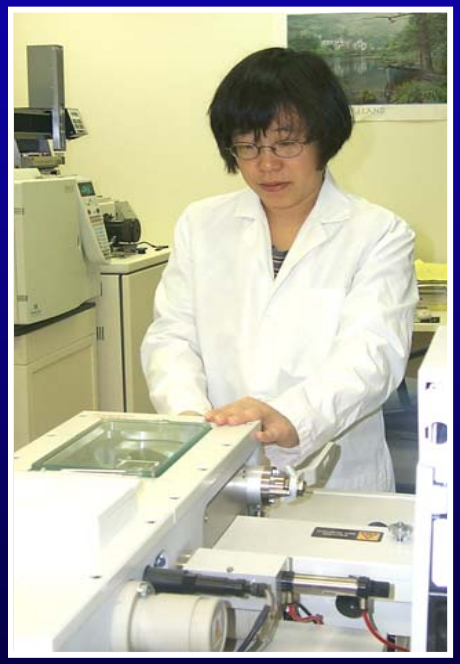
Chemical Laboratories



Chemical Terrorism Response

Improving Available Capacity

Scientific Advances

Analysis of Clinical Samples for Public Health Response to Chemical Terrorism

- Identify agent, if necessary
- Identify worried well
- Retrospective analysis
- Evaluate long-term health effects of low level exposure - registries
- Determine temporal or geographical exposure distribution

Goal

Produce interpretable laboratory results on 40 clinical samples within 36 hours of sample receipt

Flexible laboratory capabilities that can respond to the complete range of chemical emergency events

CT Laboratory Response Team

Prepared for immediate travel to event site

20 minute response, 1 hr arrival at CDC

Sample supplies in emergency packs

Support collection of clinical samples

Provide tracking information for samples

CDC Air Transport

Rapid Toxic Screen

150 chemical agents or their metabolites

In urine, serum, whole blood

Rapid Toxic Screen

Chemical warfare agents	**Nerve gases, e.g. sarin, soman, VX** **Sulfur mustards, e.g. HD, sesquimustards** **Nitrogen mustards, e.g. NH1, NH2** **Cyanide** **Lewisite**
Toxins	**Ricinine (marker for ricin)** **Saxitoxin** **Natural toxins**
Incapacitating agents	**Drugs of abuse, e.g. cocaine, opiates, PCP** **Others, e.g. scopolamine**
Industrial chemicals	**Volatile organic compounds, e.g. benzene, carbon tetrachloride** **Pesticides, e.g. malathion, parathion** **Heavy metals, e.g. lead, arsenic, mercury** **Others**

CDC
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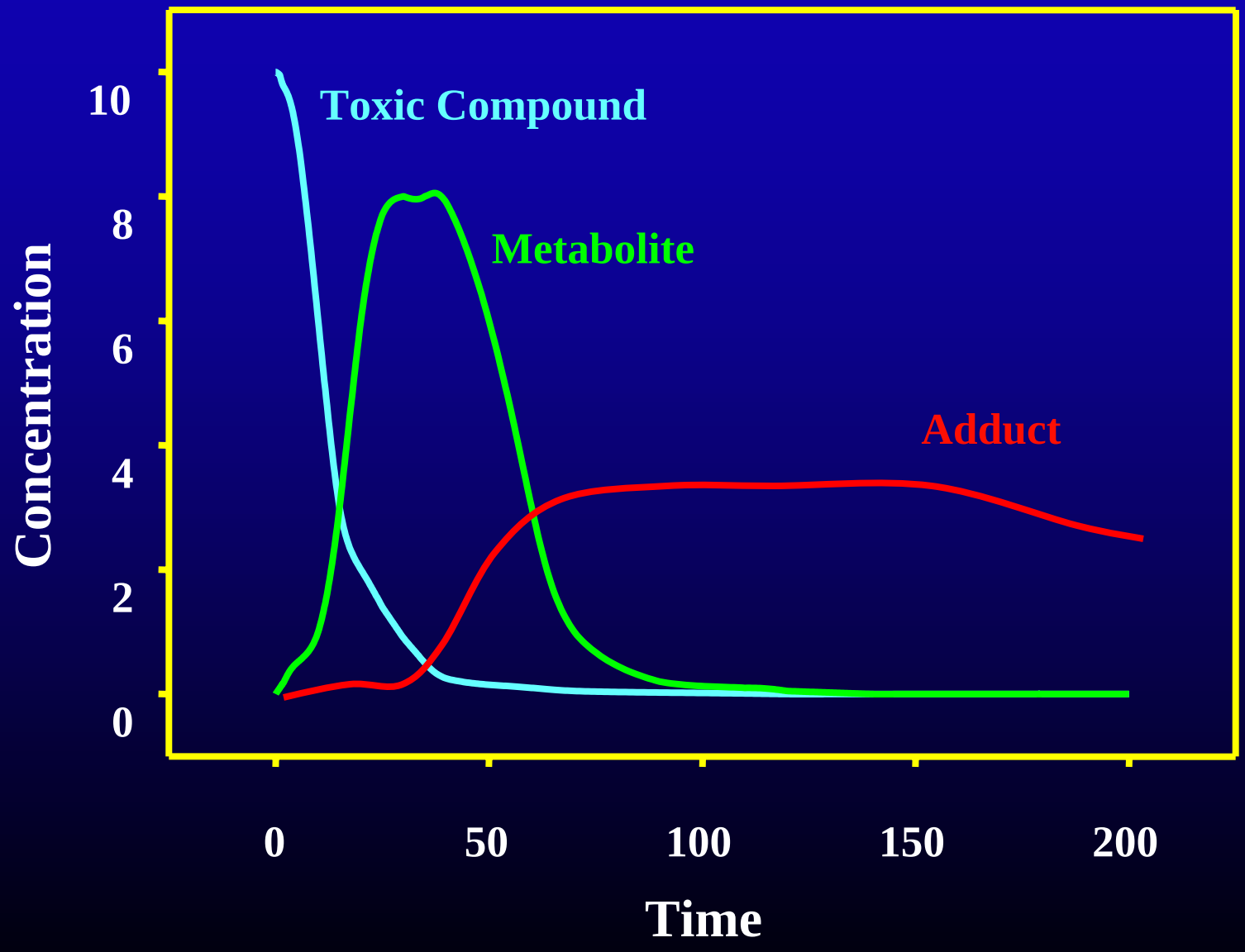
Non-persistent Biomarker Concentrations



Sample Analysis

Immediate Response

Samples collected while event in progress or within 72 hours

Retrospective Analysis

Event occurred previously

Immediate Response

Level 1 response – 1 instrument for every method, CW agents in response lab, 40 samples/day

Level 2 response – 3-4 instruments for 1-2 methods, CW agents in response and training labs, up to 200 samples/day – sustained

Level 3 response – 20-30 instruments for 1 method, all DLS resources, greater than 200 samples/day - sustained

Dual-use equipment gives us expanded capacity

Instrument	Number	CT Methods	Environmental Exposure Methods
PE Biosystems API 4000	14	Nit mustards Incap agents	Cotinine Phytoestrogens
Finnigan TSQ 7000	13	Nerve agents Sulfur mustards	OP Pesticides Phenols
Agilent MSD	16	Cyanide Lewisite	Volatiles Pesticides
Perkin Elmer Elan DRC II	10	Heavy Metals	Arsenic Cadmium

Environmental exposure staff are cross-trained in chemical terrorism analysis methods

Material Stock

Immediate sampling materials for 5000 people

Response packs ready for deplyment

Laboratory supplies stockpile

Repair parts stockpile

On call service technicians

Exercises

- 3-4 per year
- Live exercises
- Testing lab response
- Testing data transmission, approval and reporting
- Testing personnel and sample transport

Interpretation of Results

Background levels

- **Unexposed reference range**

Exposed populations

- **Historical reports**
- **Exposure incidents**

Metabolism

- **Animal studies**

State lab training, development and surge capacity

Website access to lab information

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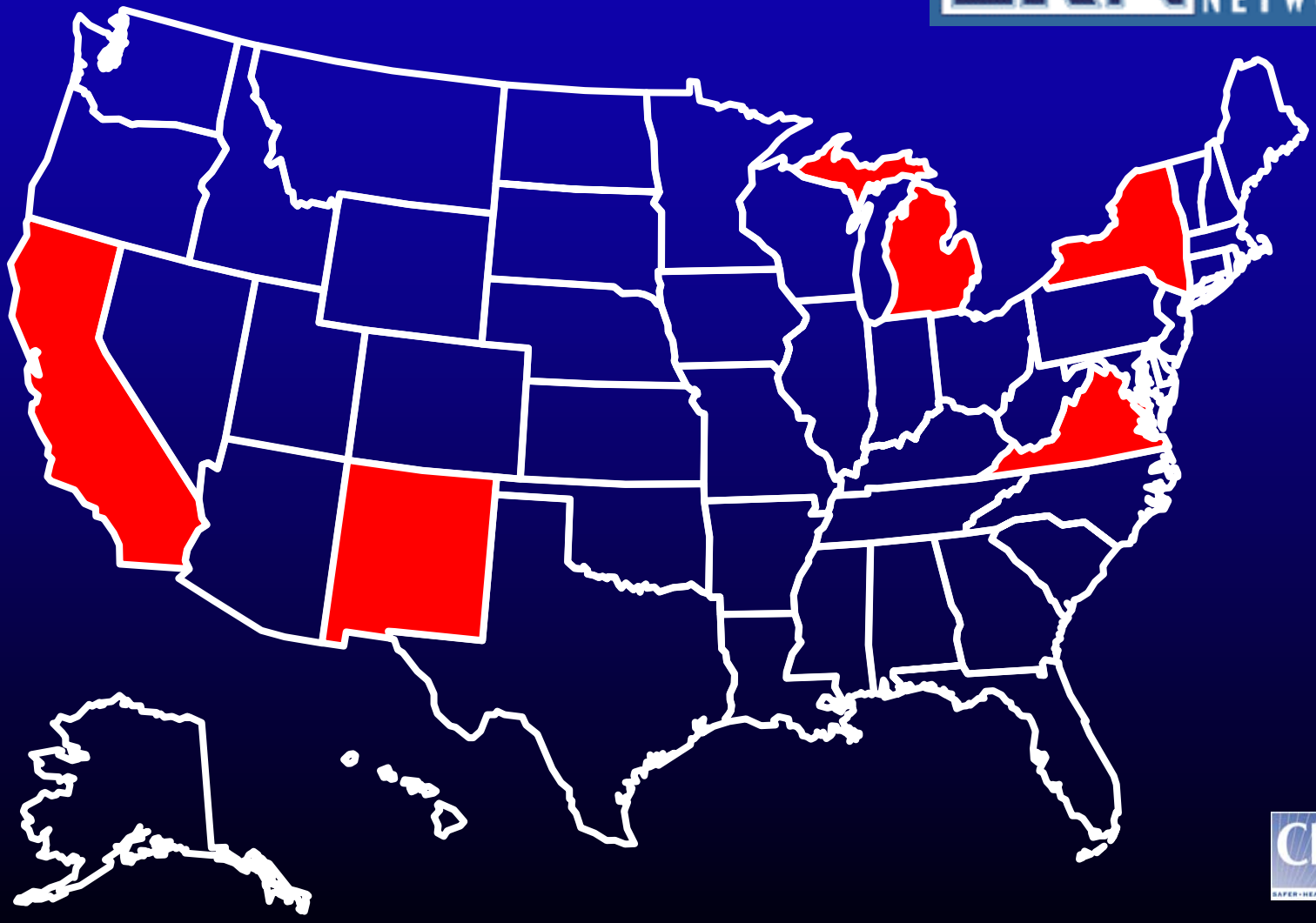
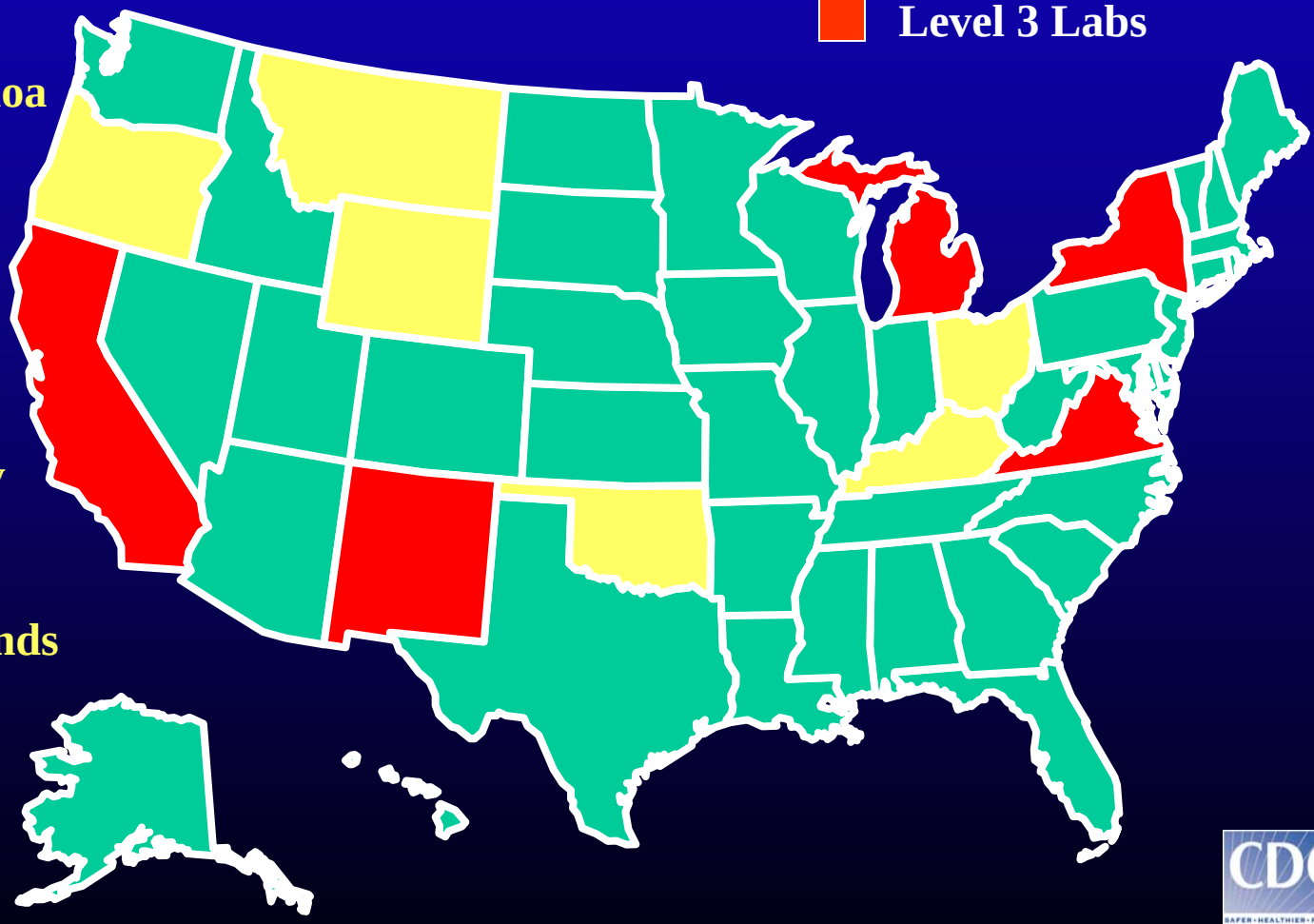
Chemical Laboratory Response Network
1999-2003



Chemical Laboratory Response Network
2003-2004

LRN LABORATORY RESPONSE NETWORK

Level 1 Labs
Level 2 Labs
Level 3 Labs



Also:
American Samoa
Chicago
Guam
Micronesia
Los Angeles
Marshall Is.
N. Mariana Is.
New York City
Palau
Puerto Rico
US Virgin Islands

District of Columbia

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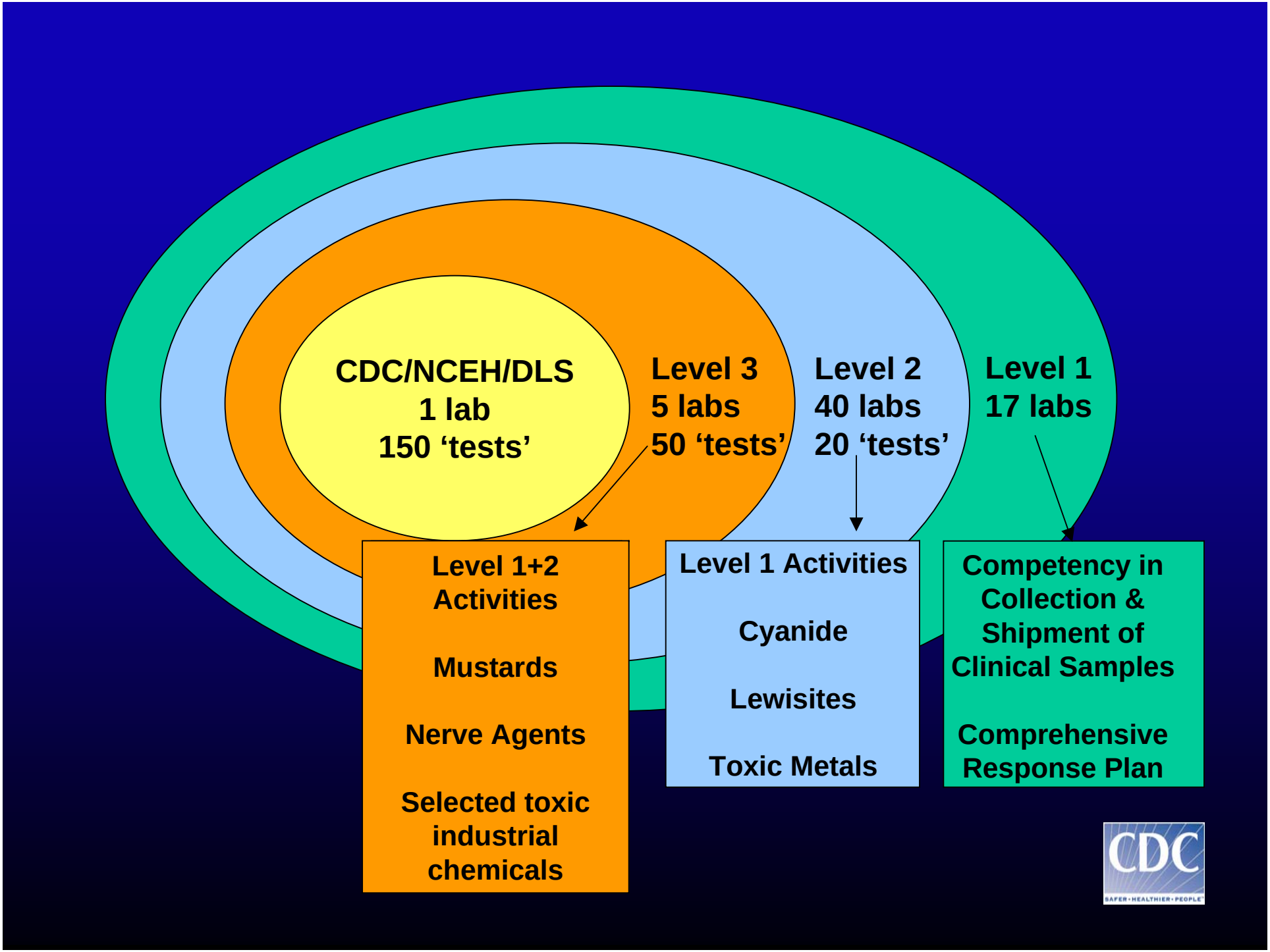
CDC/NCEH/DLS
1 lab
150 'tests'
Level 3
5 labs
50 'tests'
Level 2
40 labs
20 'tests'
Level 1
17 labs
Level 1+2 Activities
Mustards
Nerve Agents
Selected toxic industrial chemicals
Level 1 Activities
Cyanide
Lewisites
Toxic Metals
Competency in Collection & Shipment of Clinical Samples
Comprehensive Response Plan
CDC
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Technology Transfer to State Public Health Labs

Staff hiring
Lab setup

Equipment purchases
Vendor training
CDC training
Validation
IT Development
On-going proficiency testing
Exercises

LRN LABORATORY RESPONSE NETWORK

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Level 2

ICP-MS

Toxic Metals Screen

GC/MS

Cyanide, Lewisite, VOCs

Operation: Experienced B.S.

Evaluation: Experienced M.S., Ph.D.

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Level 3

Level 2 +

GC/MS/MS

Nerve Agents
Sulfur Mustards

LC/MS/MS

Nitrogen Mustards

Operation: Experienced M.S., Ph.D.

Evaluation: Experienced Ph.D.

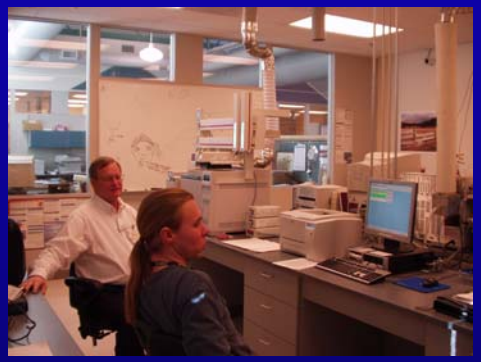
State Public Health Laboratory Equipment

	Delivered	Installed	Vendor Trained
Agilent (GC/MS)	29/44	18/44	6/44
Perkin Elmer (ICP-MS)	18/35	6/35	4/35
Gerstel (Prep-Station)	16/41	16/41	16/41

Training

Computer Based Training

Vendor Training

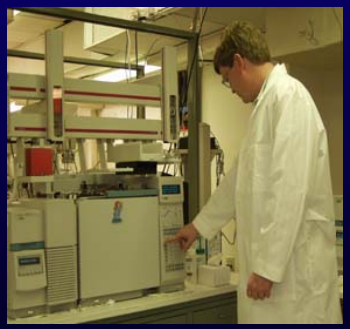


Lecture

Hands-on Sample Prep

Hands-on Operation

Video Reinforcement



Training Status

Nerve Agents – 5 level 3 labs

Sulfur mustard –TDG – 5 level 3 labs

Cyanide – 5 level 3 labs, 3 level 2 labs

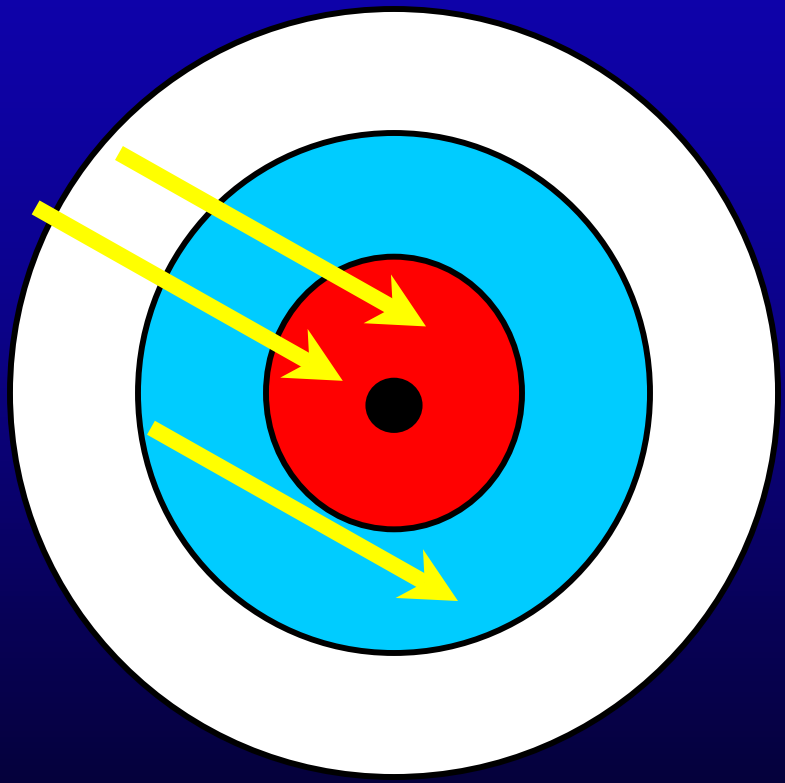
Trace metals – 5 level 3 labs, 1 level 2 lab

SBMTE (HD metabolite) – next training

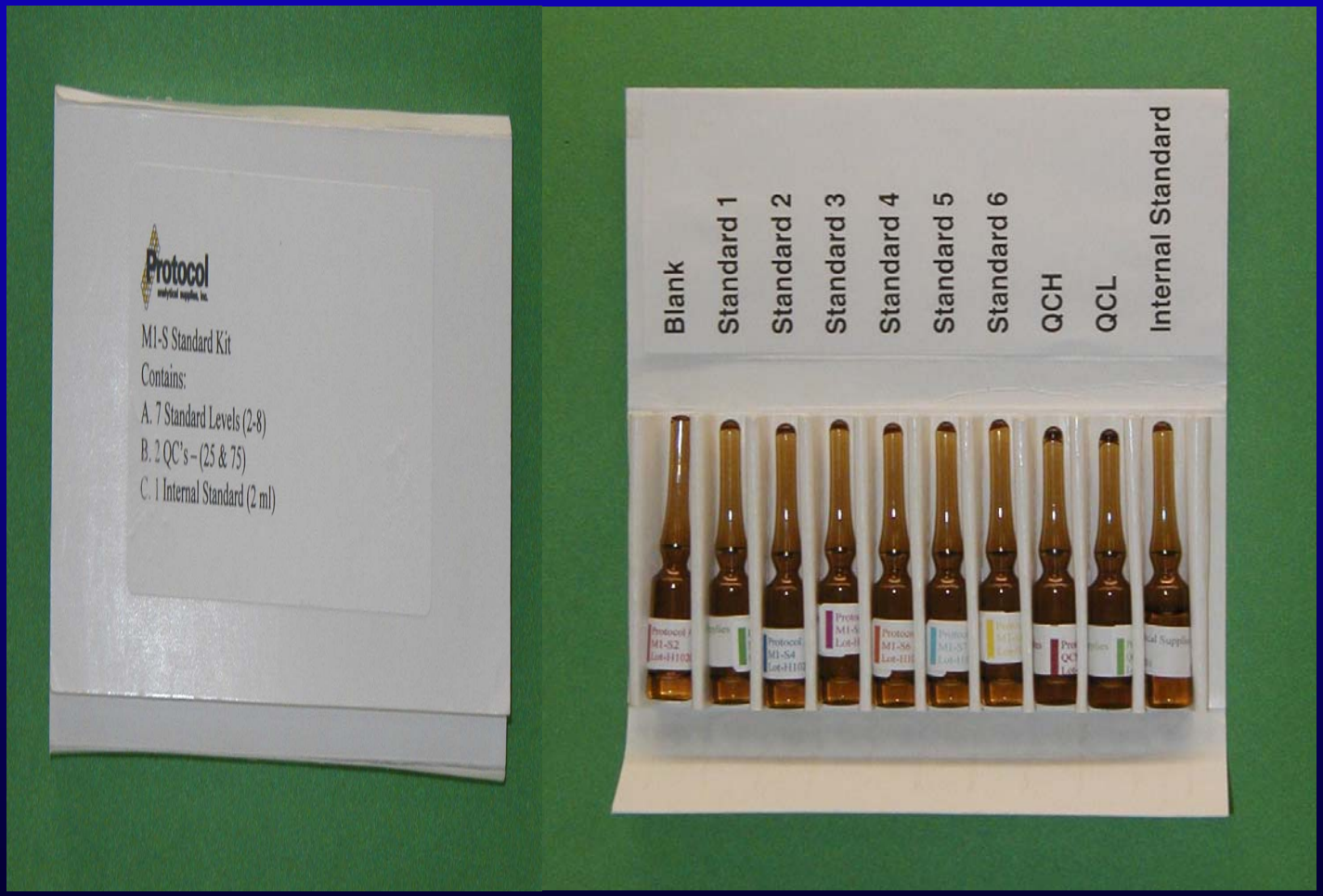
Nitrogen mustards – to follow SBMTE

Proficiency Testing

Intramural
Extramural



Thiodiglycol
Cyanide
Heavy metals
Nerve agent metabolites


Protocol
M1-S Standard Kit
Contains:
A. 7 Standard Levels (2-8)
B. 2 QC's – (25 & 75)
C. 1 Internal Standard (2 ml)
Blank
Standard 1
Standard 2
Standard 3
Standard 4
Standard 5
Standard 6
QCH
QCL
Internal Standard

Centers for Disease Control and Prevention	Rachael Trimpert 4770 Buford Hw NE Athens, GA 30341	Phone 770-488-8547 FAX 770-488-7518 Email: [redacted]

LABORATORY: **CDC (Instrument E)**

Proficiency Testing Results:

PT Challenge Start Date: 07/09/03

Method: Thiodiglycol in Urine

Instrument: TF Trace 2000 GC/TSQ 7000- Instrument E

Analyst(s): Doris Ash

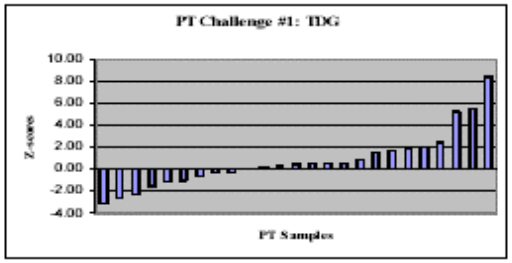
Reviewer(s): John Barr

Percentage of PT s :ssfully analyzed: **100%**

Z-scores: **-2.65, 0.[illegible], [illegible], [illegible], 2.48**

Laboratory Status: **QUALIFIED**

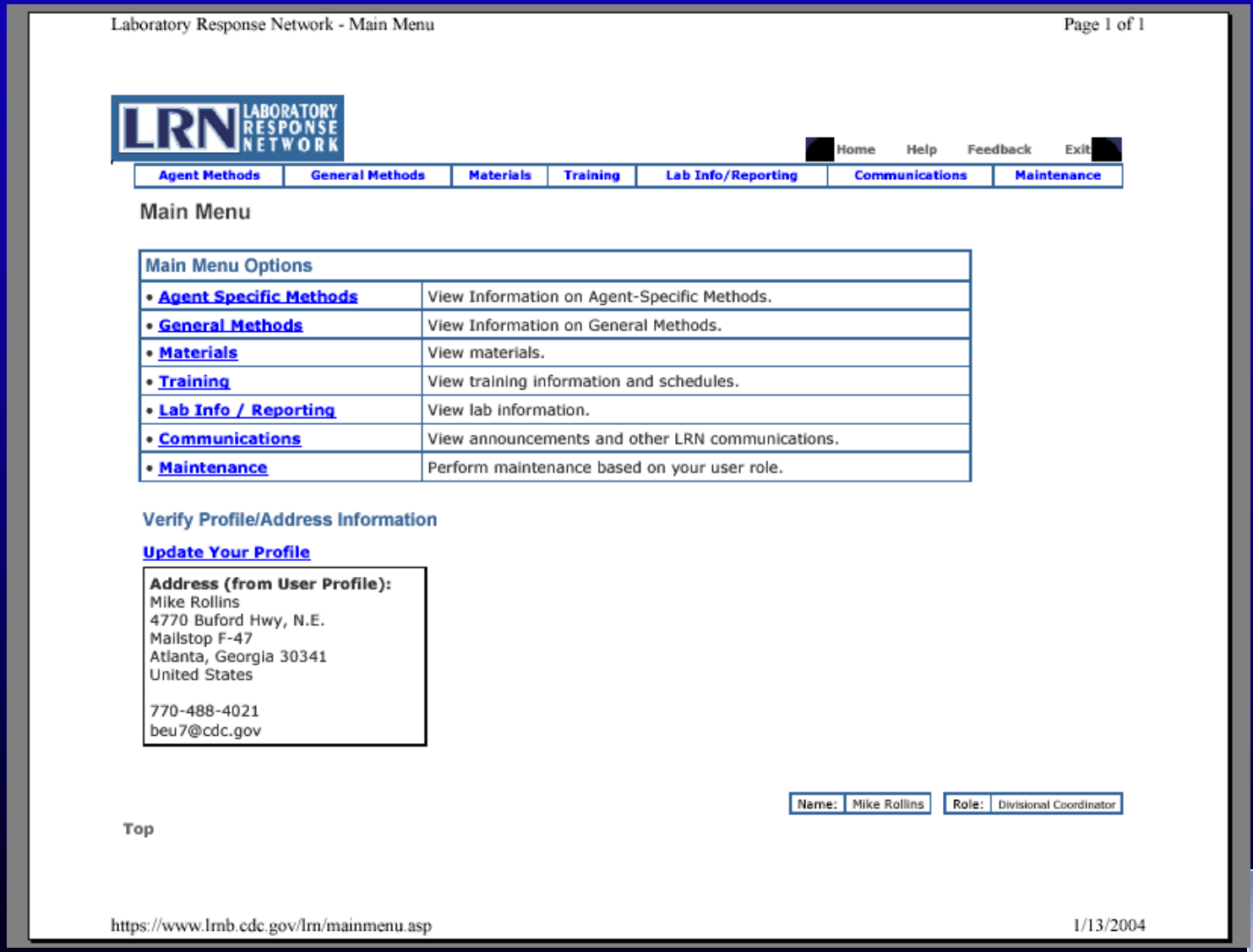
Results of Proficiency Testing Challenge represented by Z-scores



Proficiency Test Coordinator

Signature:_____ Date:_____

LRN Chemical Website



Laboratory Response Network - Main Menu Page 1 of 1

LRN LABORATORY RESPONSE NETWORK

Home Help Feedback Exit

Agent Methods | General Methods | Materials | Training | Lab Info/Reporting | Communications | Maintenance

Main Menu

Main Menu Options	
• Agent Specific Methods	View Information on Agent-Specific Methods.
• General Methods	View Information on General Methods.
• Materials	View materials.
• Training	View training information and schedules.
• Lab Info / Reporting	View lab information.
• Communications	View announcements and other LRN communications.
• Maintenance	Perform maintenance based on your user role.

Verify Profile/Address Information

Update Your Profile

Address (from User Profile):
Mike Rollins
4770 Buford Hwy, N.E.
Mailstop F-47
Atlanta, Georgia 30341
United States

770-488-4021
beu7@cdc.gov

Name: Mike Rollins Role: Divisional Coordinator

Top

https://www.lrnb.cdc.gov/lrn/mainmenu.asp 1/13/2004

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Scientific Advances in the Rapid Toxic Screen

- Ricinine in urine
- SBMTE – a specific metabolite of HD
- Nerve agents on lower technology equipment
- Quantification of botulinum toxin using mass spectrometry

Ricinine Analysis

Simple method to determine ricin exposure

1. **Both ricinine and ricin share a common plant source – beans of *ricinus communis***
2. **Ricinine is present in crude preparations of ricin – confirmed in laboratory**
3. **Animal study showed that ricinine can be quantified in urine up to 48 hours after exposure**

Ricinine

CDC
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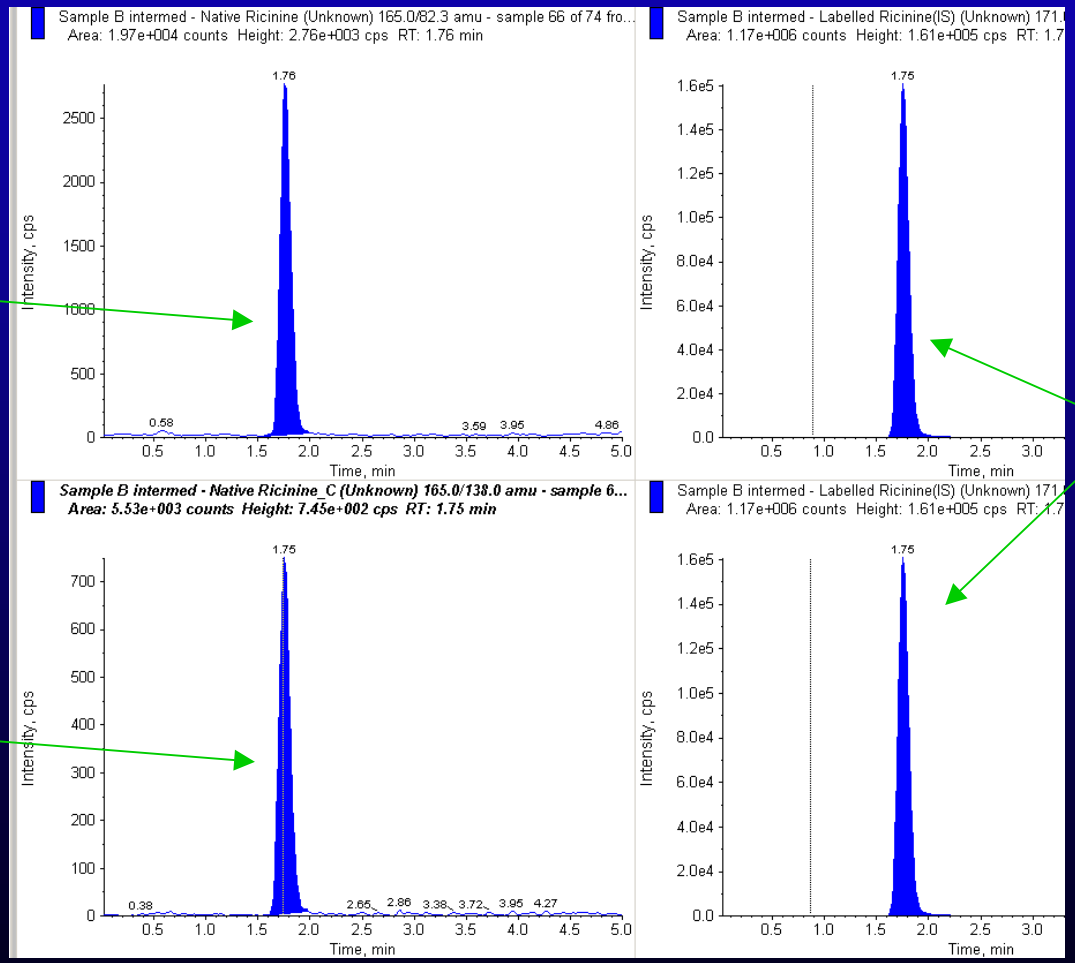
Criminal Ricin Preparation

Analysis via Isotope Dilution Mass Spectrometry

Ricinine Quantitative Peak



Carbon -13 Labeled Ricinine

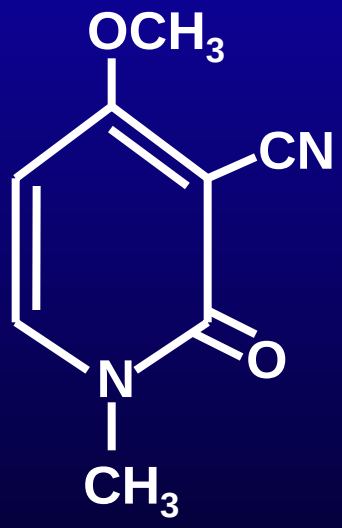
Ricinine Confirmation Peak

Ricinine Analysis

Ricin and Ricinine are derived from *ricinus communis*

Method Characterization	Analytical Result
Operating Range	0.3 – 800 ng/mL
Criminal ricin preparation (milky solution)	502 ng/mL
Levels of ricinine in rat urine (48 hrs)	400 ng/mL
Forensic Analysis	5 ng/mL

Ricinine



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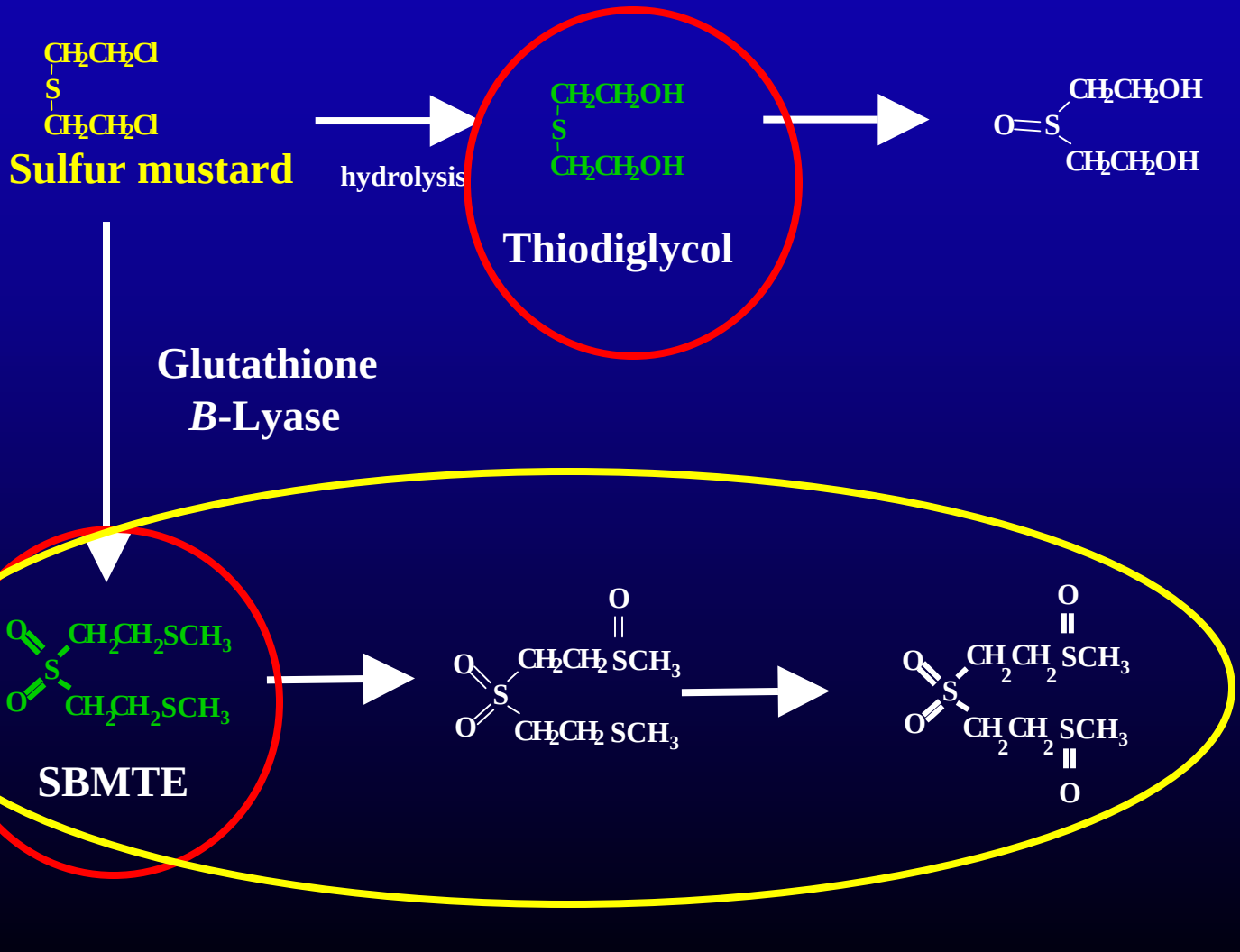
Urinary HD Metabolites

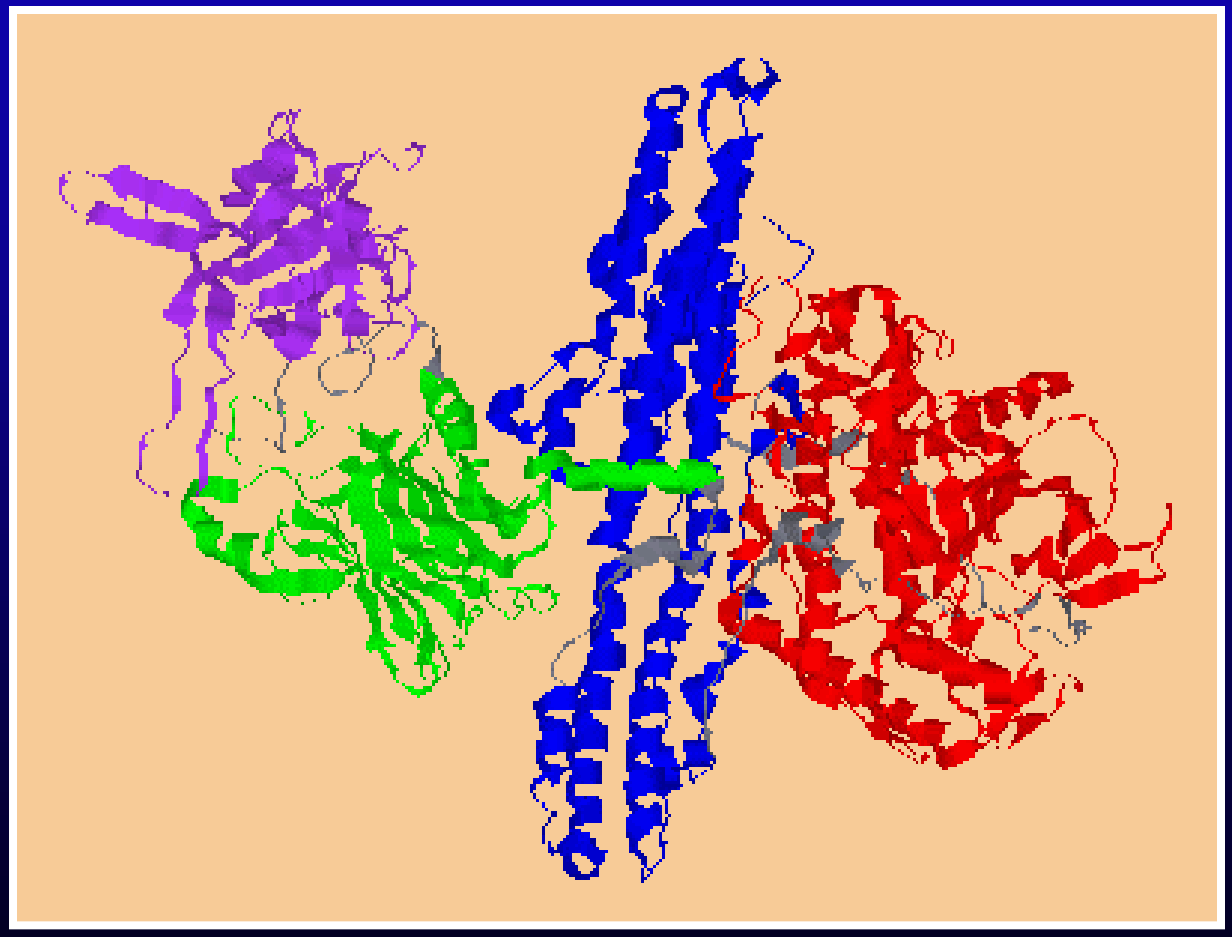


Nerve Agent Metabolite Analysis in Urine

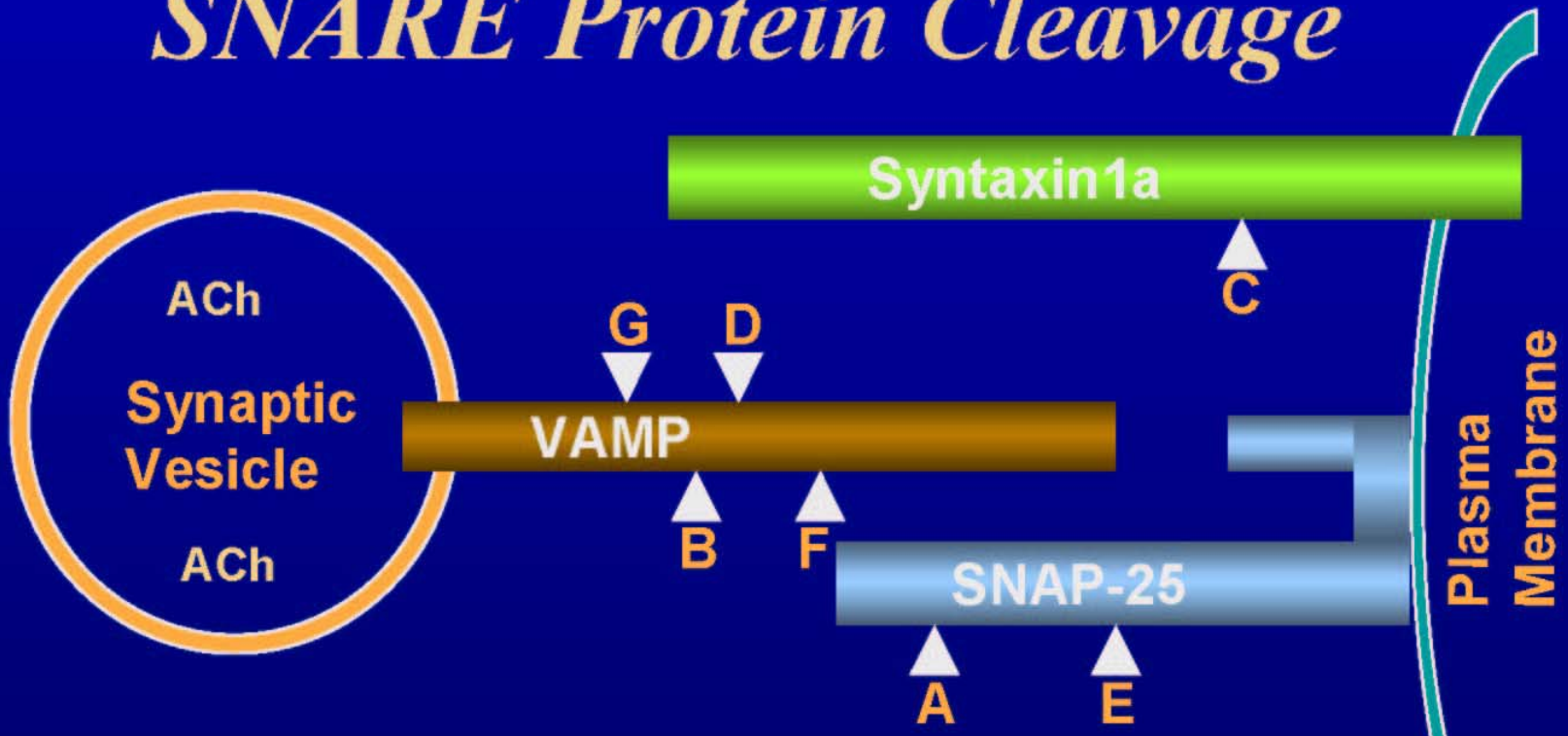
Level 3: GC/MS/MS

Level 2: GC/MSD

Botulinum Toxins



SNARE Protein Cleavage

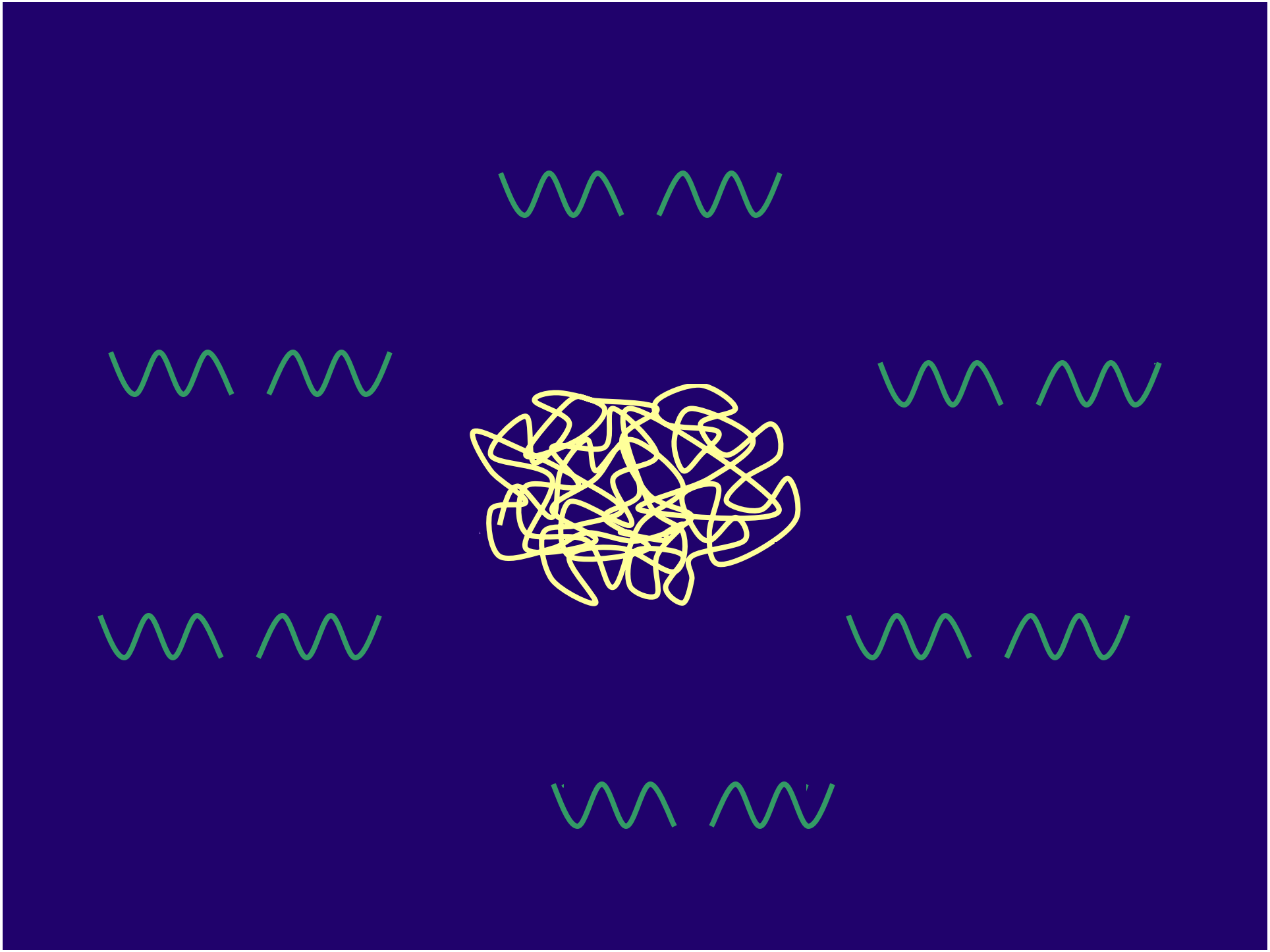


SNAP-25 ⟶ **BoNt A, C and E**

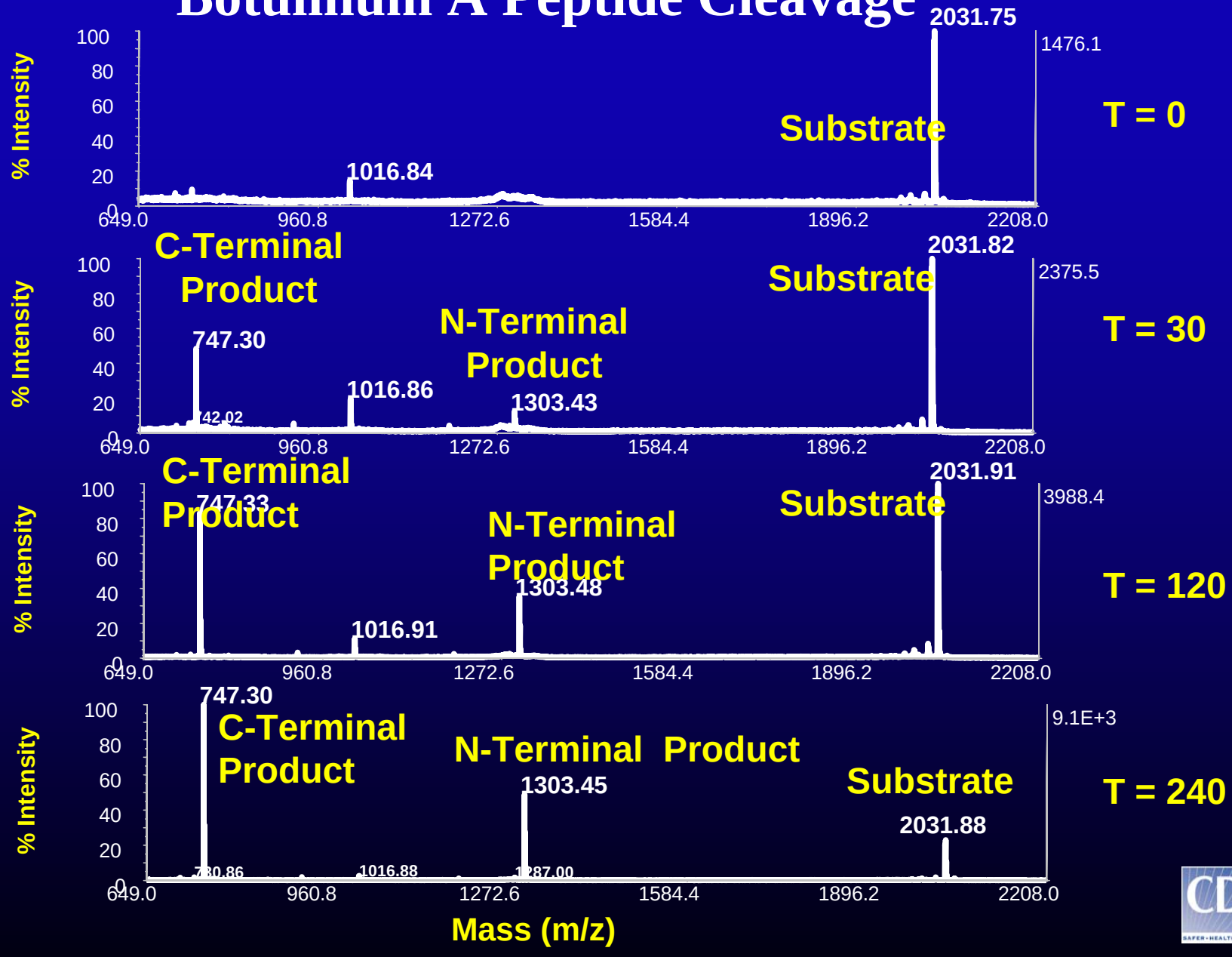
VAMP-2 ⟶ **BoNt B, D, F, G & Tetanus**

Syntaxin 1a ⟶ **BoNt C**

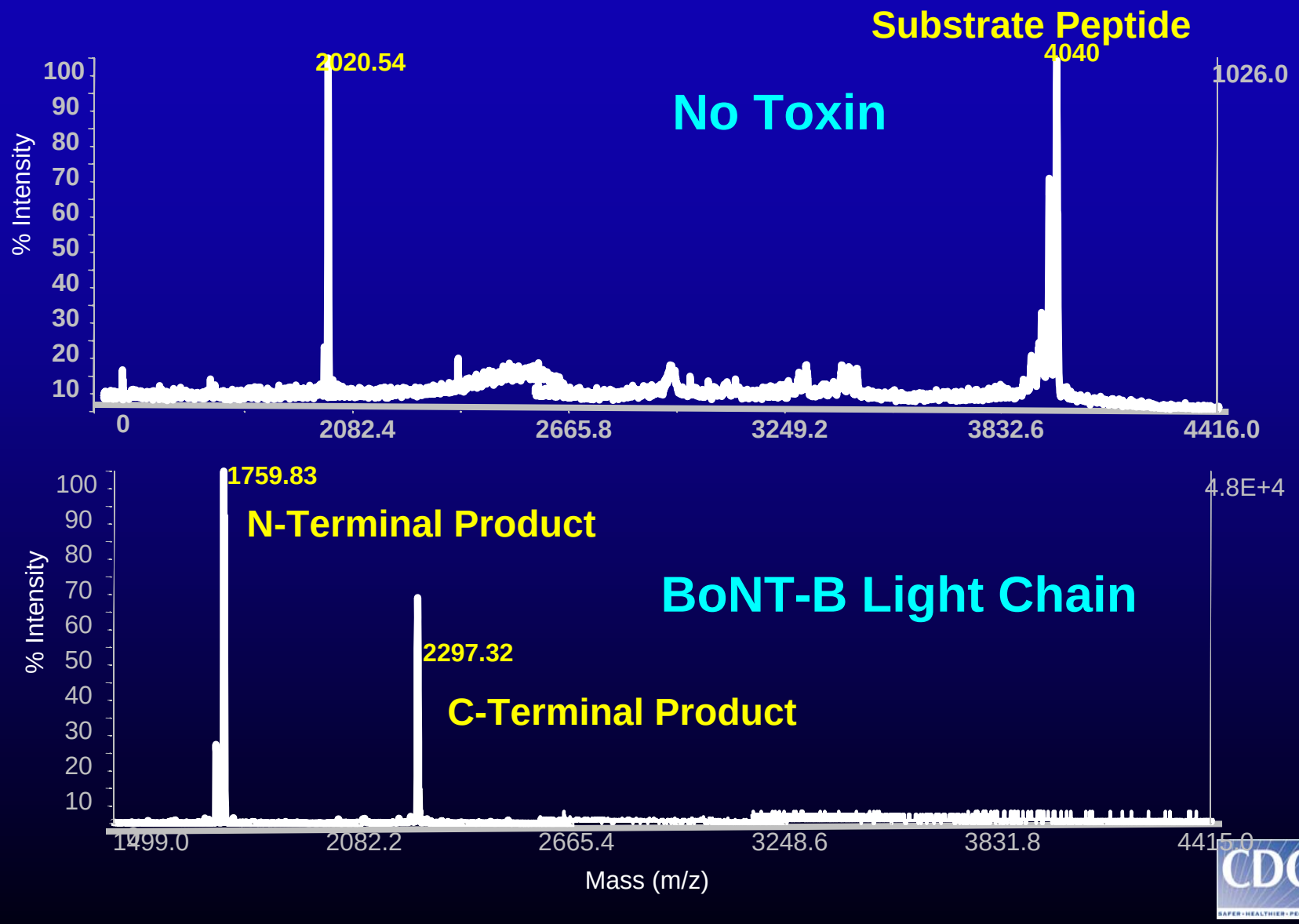
The seven different serotypes of BoNT target different proteins of the SNARE complex.



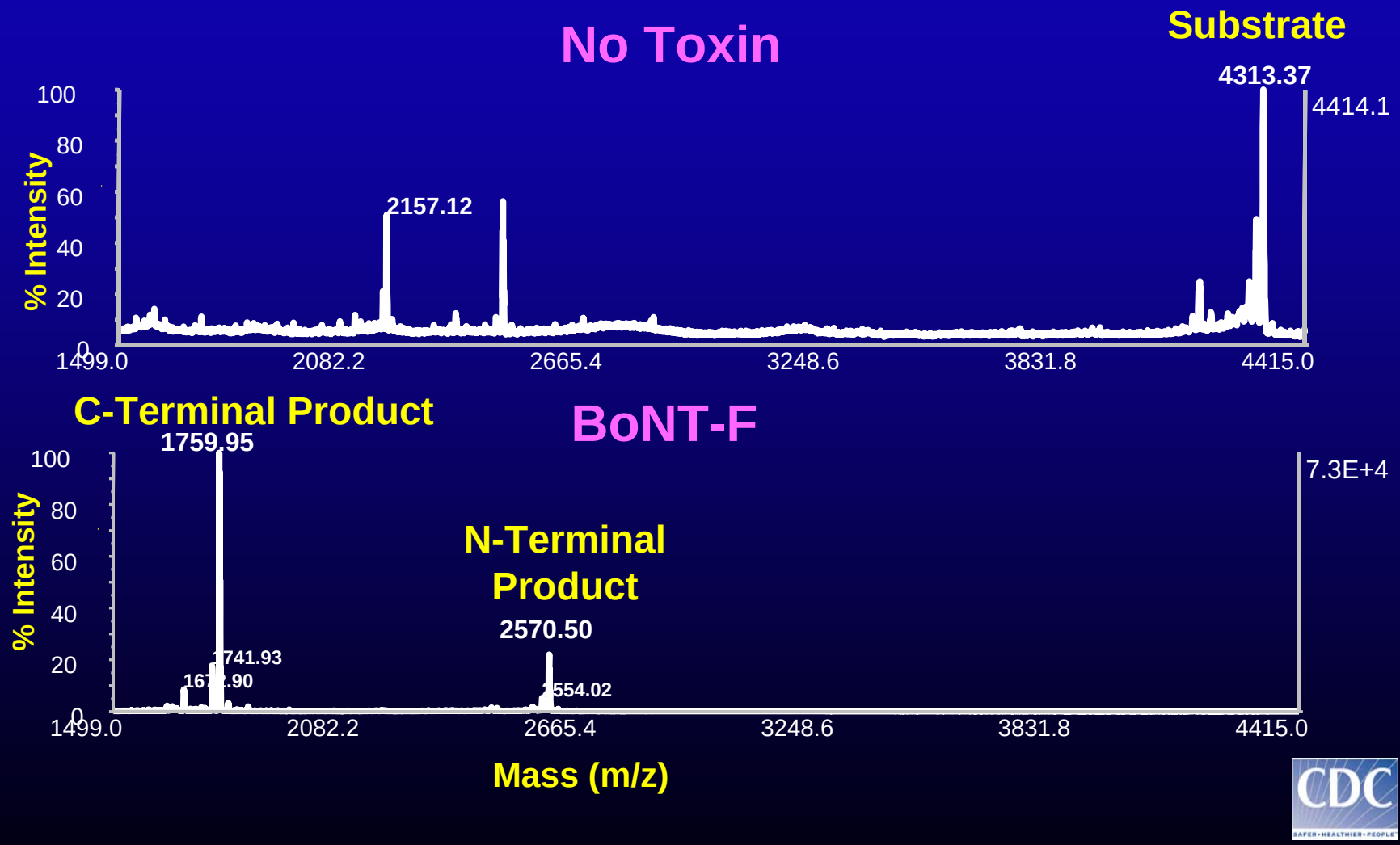
Botulinum A Peptide Cleavage



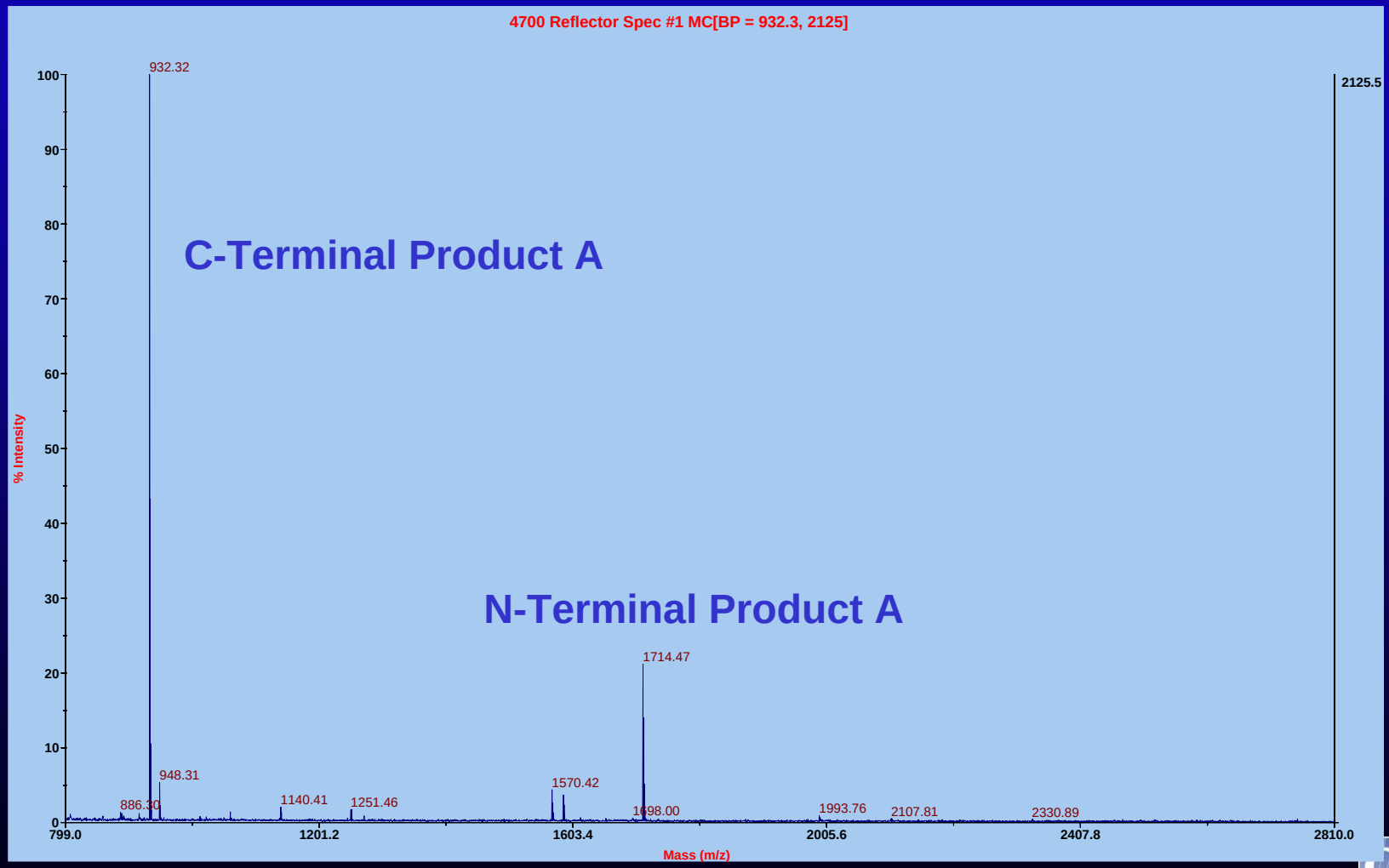
Botulinum B Light Chain Cleavage



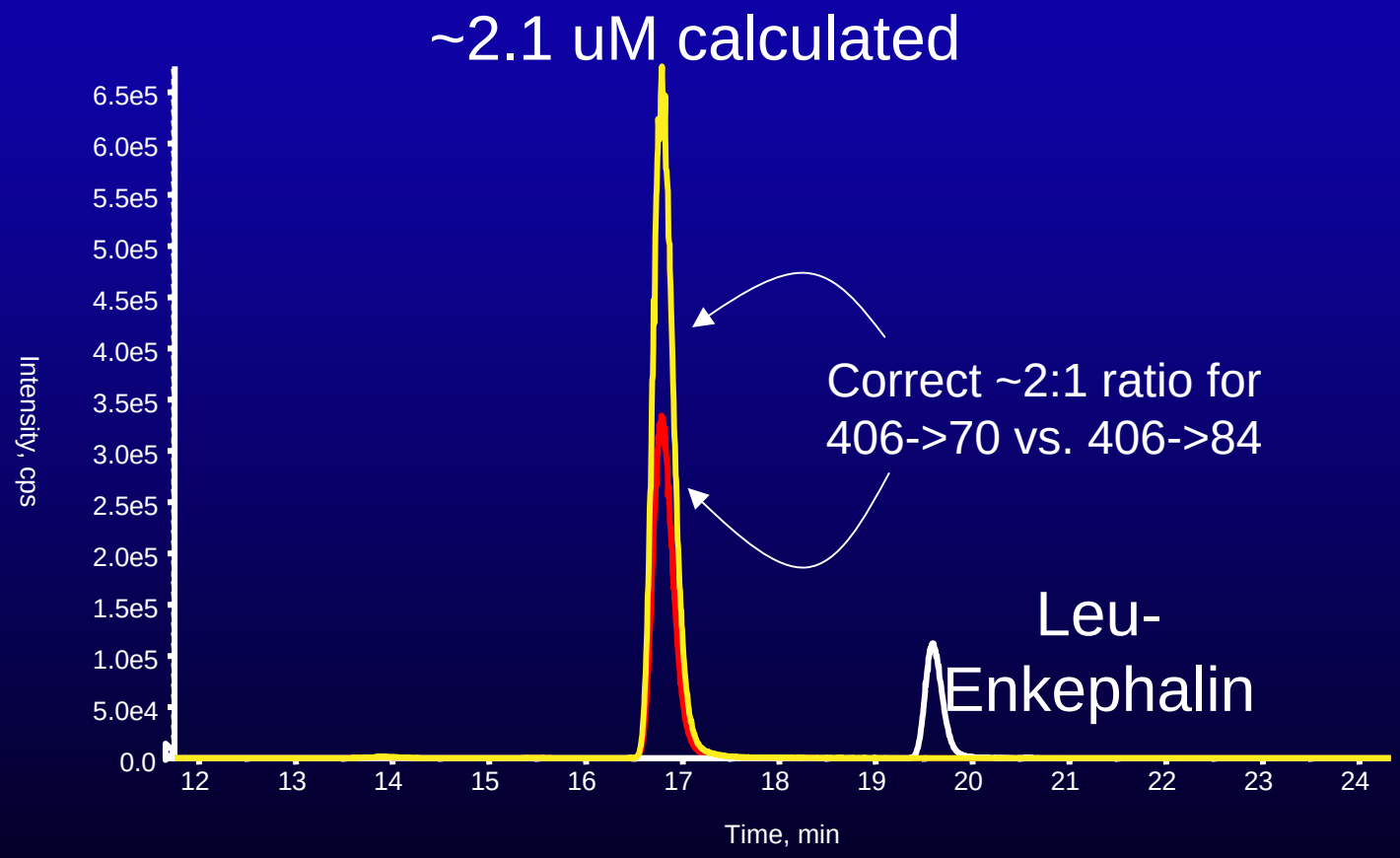
Two Hour Peptide Cleavage by BoNT-F Complex



Milk Spiked with BoNT Light Chain (0.45 ng) 2h reaction - Typical Spectrum

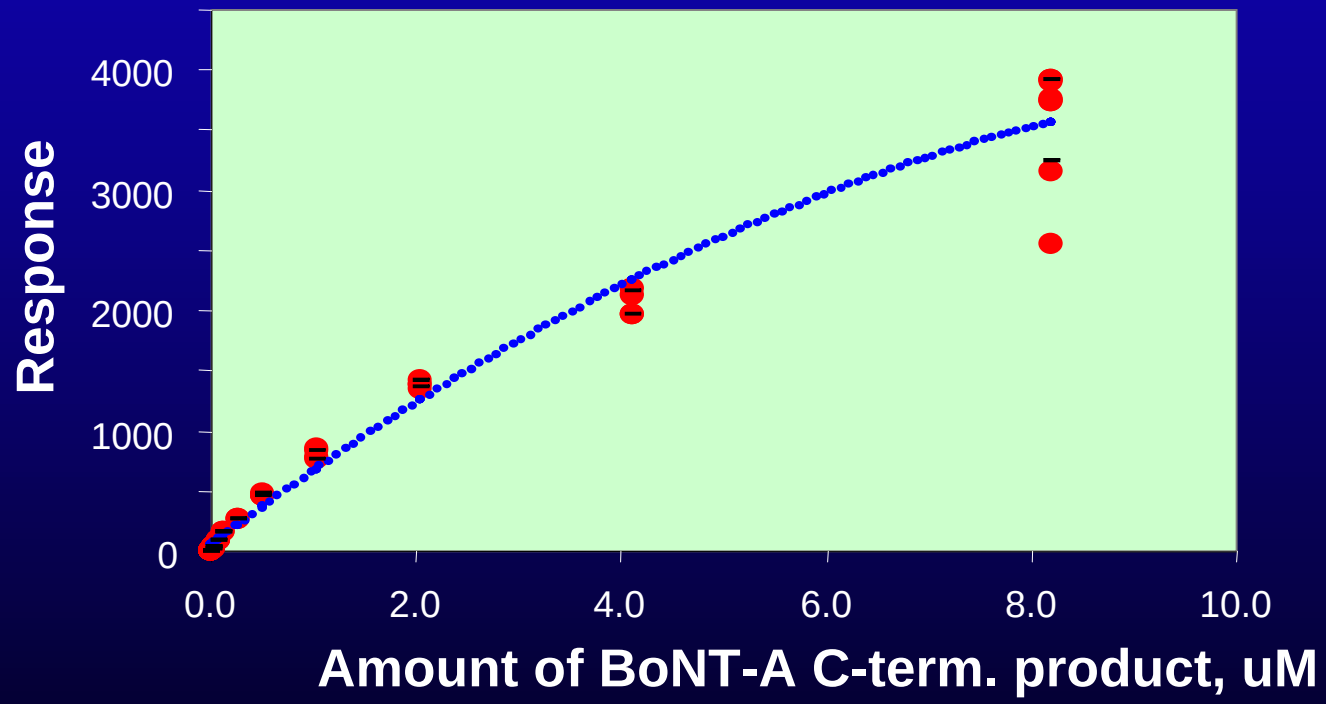


~2 uM BoNT C-term. Product in a Digest



243 ng/ml of BoNT-A light chain

Typical Standard Curve, 0.001-8.2 uM (25 ul inj's)



Botulinum Mass Spectrometric Assay

- As sensitive or better than the mouse assay
- 4-hour turnaround
- Can distinguish all A-G serotypes
- Applicable to food, stool and clinical samples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